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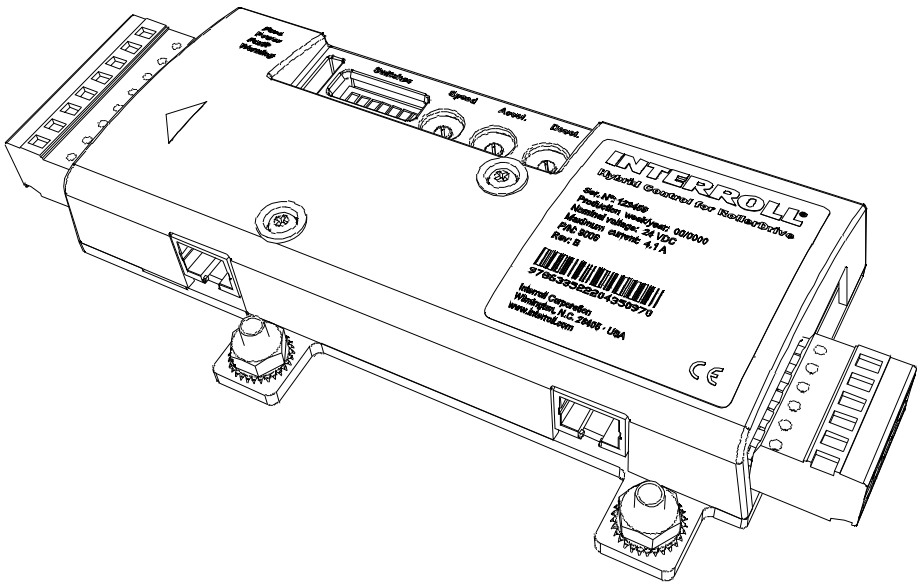

User Manual

Interroll
9007 Hybrid Control for RollerDrive
EC100
EC110
EC120 (future)

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Introduction

Handling of the user manual

In this manual the 9007 Hybrid Control for RollerDrive for the EC100, EC110, EC120 is referred to as 9007.

Content of the manual

This manual contains important advice, notes, and information about the 9007 in all phases of its lifecycle:
- Transport, assembly, and commissioning
- Safe operation, maintenance, troubleshooting, and disposal
- Accessories

Validity of the manual

The manual describes the 9007 as it is delivered by Interroll.

Special application designs require validation from Interroll and additional technical instructions.

This manual is part of the product

- ➢ For trouble-free, safe operation and warranty claims, read this manual and follow the instructions before handling the 9007.
- ➢ Keep this manual near to the 9007.
- ➢ Pass this manual on to any subsequent operator or occupant of the 9007.
- ➢ Interroll does not accept any liability for malfunctions or defects due to non-observance of this manual.
- ➢ If you have any questions after reading this user manual, feel free to contact our customer service. See the last page for contact information.

Warnings in this manual

The warnings in this document refer to risks which may arise while using the 9007. For relevant warnings, *see "Safety", page 4* and the warnings at the beginning of each chapter.

There are three categories of danger. The following signal words are used in the document as required:
- Danger
- Warning
- Caution

Signal word	Meaning
Danger	Indicates a hazardous situation which, if not avoided, will result in death or serious injury.
Warning	Indicates a hazardous situation which, if not avoided, could result in death or serious injury.
Caution	Indicates a hazardous situation which, if not avoided, may result in minor or moderate injury.

Structure of warnings

⚠ DANGER

Nature and source of the hazard
Possible consequence of non-observance

➢ Information about how to avoid the hazard.

Introduction

Further symbols

NOTICE

This symbol identifies possible material damage.
➢ Information about how to avoid damage.

This symbol displays safety instructions.

This symbol marks useful and important information.

➢ This symbol marks the steps that have to be carried out.

Safety

General safety instructions

The 9007 is designed according to the technical state of the art and is reliable in operation, once distributed. However, risks may still arise.

- Risks of physical injury to the user or bystanders.
- Adverse effects of the 9007 and other material.

Disregarding the warnings in this manual may lead to serious injury.

- ➢ Always read the entire operating and safety instructions before starting to work with the 9007 and follow the information contained herein in full.
- ➢ Only instructed and qualified persons may work with the 9007.
- ➢ Always keep this user manual at hand when working on the 9007 so that you can consult it quickly if required.
- ➢ Always comply with relevant national safety regulations.
- ➢ If you have any questions after reading this user manual, feel free to contact our customer service. See the last page for contact information.

Intended use

The 9007 may only be used for industrial applications and in an industrial environment to control a RollerDrive EC1xx. It must be integrated in a conveyor module or a conveying system. Any other use is considered inappropriate.

Use of the 9007 is only allowed in the areas described under product information.

Any changes that affect the safety of the product are not allowed.

The 9007 may only be used within the given operation limits.

Unintended use

Applications not according to the intended use of the 9007 require approval from Interroll.

Safety

Qualified persons

Qualified persons are persons who read and understand the manual and, taking national regulations into account, can competently execute incidental work.

Only instructed and qualified persons may work with the 9007, taking the following into account:

- the relevant manuals and diagrams,
- the warning and safety instructions in this manual,
- the system specific regulations and requirements,
- national or local regulations and requirements for safety and accident prevention.

Risks

The following list informs you about the various types of danger or damage that may occur while working with the 9007.

Persons

- ➢ Maintenance or repair work must only be executed by authorized and qualified persons in accordance with the applicable regulations.
- ➢ Before using the 9007, ensure that no unauthorized persons are near the conveyor.

Electricity

- ➢ Only perform installation and maintenance work after you have switched off the power. Ensure that the power cannot be turned on accidentally.

Working environment

- ➢ Do not use the 9007 in explosive atmospheres.
- ➢ Remove equipment or material which is not required from the workspace.

Avoiding malfunctions in operation

- ➢ Regularly check the 9007 for visible damage.
- ➢ In case of fumes, turn off the power at once and ensure that it cannot be turned on accidentally.
- ➢ Contact qualified personnel immediately to find the source the malfunction.

Maintenance

- ➢ As the product is maintenance free, you only need to check regularly for visible damage and that all leads and screws are still tightened.

Interfaces

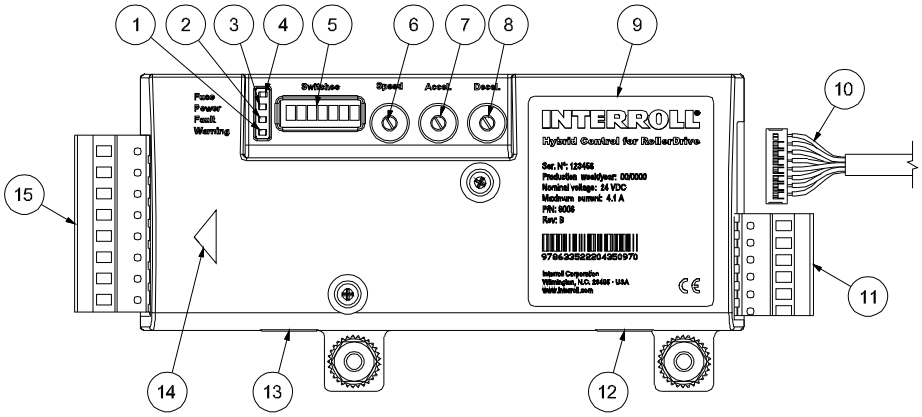
By assembling the 9007 in a conveyor module, potential hazards may occur. These are not described in this manual and have to be analyzed during the design, installation, and startup of the conveyor module.

- ➢ After assembling the 9007 in a conveyor module, check the whole system for any new potential dangerous condition prior to turning on the conveyor.

Product information

The 9007 has ZPA and motor control functionality on board. If no peer-to-peer port is connected and DIP switches 4 and 5 are set to OFF, it switches automatically from ZPA-mode to motor control mode only.

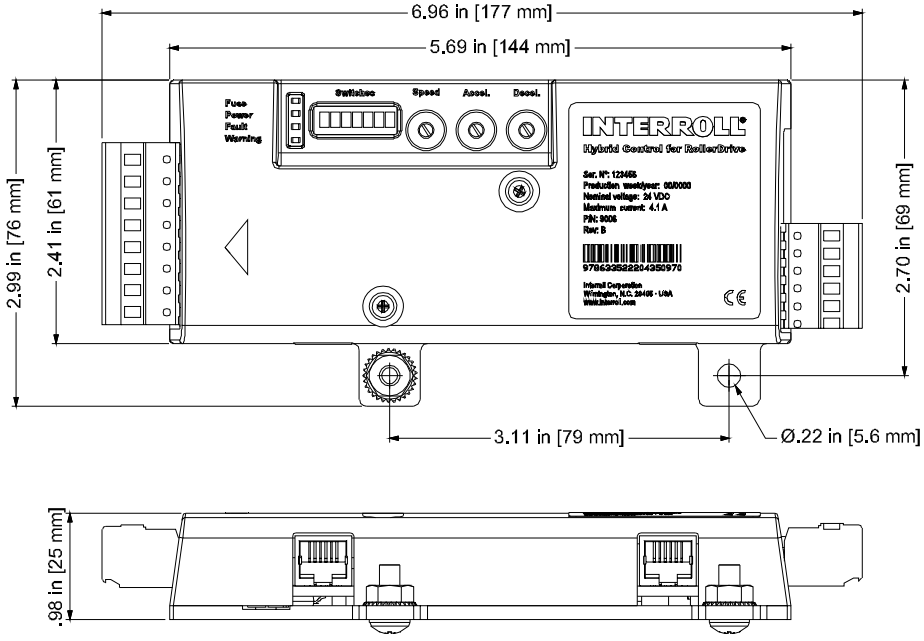
Components



1. Warning LED (amber)
2. Fault LED (red)
3. Power LED (green)
4. Fuse LED (red)
5. DIP switches
6. Speed potentiometer
7. Acceleration potentiometer
8. Deceleration potentiometer
9. Label
10. Motor cable of RollerDrive
11. Sensor connection
12. Upstream connection
13. Downstream connection
14. Direction of travel
15. Power input and I/O terminal

Product information

Dimensions



Mounting hardware

The following mounting hardware is supplied:

- 2x button head screw 10-32 UNF x 0.5"
- 2x nut with captive star washer 10-32 UNF

ZPA technology

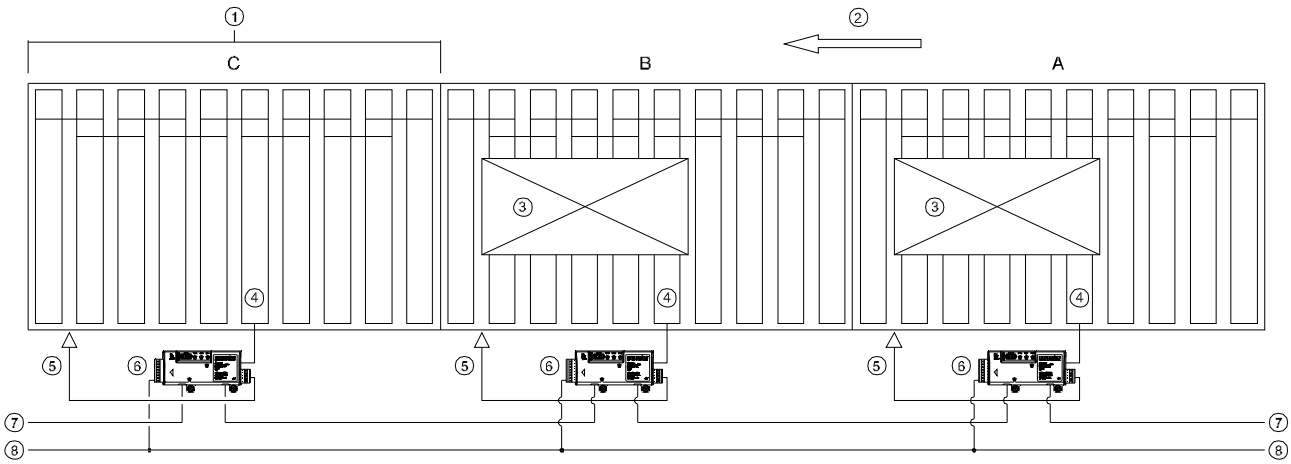
ZPA is short for zero pressure accumulation. The 9007 provides true zero pressure accumulation and other control options to a conveyor system. Each 9007 controls a RollerDrive unit, which in turn drives idler rollers using O-rings or other belts. The 9007, the RollerDrive, and the idler rollers (with associated sensors and switches) are assembled into a short conveyor section – a zone.

Zero pressure accumulation occurs as zones hold packages until the next downstream zone clears its sensor. When accumulation occurs, a low signal is passed upstream until each consecutive zone is occupied. Packages never push each other, and no line pressure occurs.

A logic-controlled, zero pressure conveyor is created when a number of zones are connected together and a simple six-wire phone cable links each 9007 electronically. The RollerDrives only operate when a package is detected by a photoeye. If the downstream zone is empty, the package moves forward.

Product information

Principle of zones



Typical ZPA conveyor configuration

① Zone
② Direction of travel
③ Load
④ RollerDrive
⑤ Photoeye
⑥ 9007
⑦ Peer-to-peer communication cable
⑧ +24 VDC / GND

Zone A has a package at the photoeye. The 9007 of zone A recognizes its presence, checks zone B for availability and requests permission to transfer the package to zone B. Since zone B has also a package, its 9007 denies the permission until this package has been transfered to zone C (singulation mode), or has at least started being transfered (enhanced singulation mode). The singulation method depends on the setting of DIP switch SW3.

The 9007 of zone A will only start to operate the RollerDrives in its zone after it gets permission from the 9007 of zone B.

Product information

Product description

Features

- **Zone-to-zone communication**: Activities in upstream and downstream zones are monitored by photoeyes to permit control in various situations.
- **Learn Mode:** During system startup, the 9007 will automatically set the zone length and save it, simply by running an object from the upstream photoeye to the downstream photoeye.
- **Diagnostics**: LEDs provide motor, sensor, and jam diagnostics as well as power, fuse, and temperature status.
- **Reverse or jog entire system**: Switch settings and connections on the board allow the user to reverse the zone-to-zone logic, jog the entire system, or reverse or jog parts of the system, or bypass those functions altogether (default) without the use of external cards.
- **NPN or PNP**: All inputs and outputs can be switched, collectively, for NPN or PNP with one switch. Only "No fault output" is always active high (failsafe function with 24 VDC in "No fault status").
- **Multiple dependent RollerDrives in one zone**: Up to three RollerDrives can be run from one 9007 (and two dependent cards) to achieve multiple RollerDrives in a single zone. This signal can also be used by a PLC as a "motor running" status input.
- **Smart braking**: Depending on upstream and downstream zone occupancy, the RollerDrive will brake if needed, and coast if no braking is required. This saves on power, heat, and vibration in the RollerDrive and ultimately in the system. When no photoeyes are blocked in the system, all RollerDrives are in coast mode.
- **Dynamic braking**: RollerDrive acts like a generator and the 9007 feeds back current into the RollerDrive windings.
- **Zero motion hold**: When the 9007 has no start signal, the RollerDrive will be held in place.
- **Advanced braking**: The combination of dynamic braking followed by zero motion hold provides superior braking and holding for many applications.

Operation modes

The operation modes of a RollerDrive conveyor with 9007 Hybrid Controls include:

- **Standby**: The RollerDrives are turned off if the zone is empty.
- **Accept**: When a load reaches the sensor at the upstream end of the zone, the RollerDrives turn on to accept it.
- **Transfer**: The RollerDrives continue to run to ensure that the load entering the upstream end of the zone is transferred to the downstream end. This creates a smooth transition and high throughput.
- **Discharge**: The RollerDrives in the zone continue running to discharge the load if no accumulation command is received from the downstream zone.

Product information

Safety and stall functions

There are different levels of over-temperature or stall-related functions:

- **Jam protection**: If the 9007 detects a jam or obstruction at the downstream end of the zone, it sends an accumulation signal to the upstream zone, preventing a build-up of accumulation pressure that could cause product damage or personal injury.
- **Motor temperature foldback**: At a motor temperature of 80 °C (176 °F) the 9007 will fold back peak current down to continuous current. This is indicated by the amber LED lighting up constantly. When the RollerDrive cools down, the amber LED extinguishes, and the maximum peak current is now possible again. The motor can run at this reduced current limit indefinitely without harming the 9007 or the motor.
- **Motor temperature shutdown**: At a motor temperature of 100 °C (212 °F) the 9007 will shut down the motor and the motor will go into dynamic braking. This is indicated by the red led flashing five times. When the RollerDrive cools back down, the red LED stops flashing and motor operation will resume.
- **Motor stall current limiting**: When the motor is stalled, the current will fold back to 1.4 A until the stall is cleared.
- **9007 temperature foldback**: At a card temperature of 70 °C (158 °F) the 9007 will foldback peak current down to continuous current. This is indicated by the amber LED lighting up constantly. When the 9007 cools down, the amber LED extinguishes, and the maximum peak current is now possible again. The 9007 can run at this reduced current limit indefinitely without harming the 9007 or the motor.
- **9007 temperature shutdown**: At a 9007 temperature of 90 °C (194 °F) the 9007 will shutdown the motor and the motor will go into dynamic braking. This is indicated by the red LED flashing four times. When the 9007 cools back down the red LED stops flashing and motor and 9007 operation will resume.

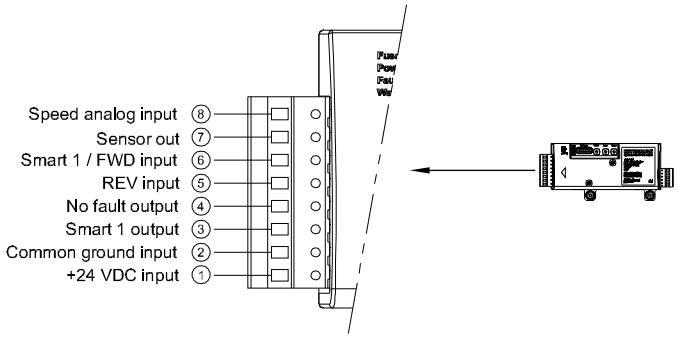
Incline and decline applications

Due to the zero motion hold and regenerative braking features, the 9007 and RollerDrive EC1xx can be used for incline and decline applications up to an angle of 15°.

Product information

Inputs and outputs

Power input and I/O connections



⑧ **Speed analog input:** External speed control down to approximately 33% of the maximum speed. When using a 10 kΩ external potentiometer, the wiper must be connected here. The on-board rotary switch should be set to maximum (CW) so it will not affect the external speed setting (for the wiring diagrams *see page 19*).

⑦ **Sensor out:** Mimics the Sensor 1 input signal from pin 4 on the sensor connection. Unchanged by zone type. (see sensor connections *page 12*).

⑥ **Smart 1 / FWD input:** Has various functions depending on zone type:

- In entry zone: acts as a start signal for the handshake with previous machines or conveyors.
- In exit zone: acts as a start signal to discharge the conveyor as handshake to following systems.
- In transport zone: acts as jog signal for the specific zone or the whole conveyor (depending on the DIP switch settings)
- In dependent zone: acts as jog command to run the motor.

This input is PNP/NPN selectable (with DIP switch 1).

⑤ **REV input:** Invokes the system reverse function, causing all interconnected controls to operate in reverse transport mode while the signal is active. When in dependent mode, the motor will simply run in reverse while this signal is active. This input is PNP/NPN selectable (with DIP switch 1).

④ **No fault output:** Active high (+24 VDC) when either in NPN or PNP mode. Signal goes low only when system faults occur.

③ **Smart 1 output:** Has various functions depending on zone type:

- In entry zone: reflects the status of the zone (occupied or free) for handshake with previous systems.
- In exit zone: reflects the status of the zone (occupied or free) for handshake with following systems.
- In transport zone: is the connection to control a second RollerDrive in the zone by interfacing with Smart 1 IN of the dependent zone.
- In dependent zone: reflects the status of the sensor.

This output is PNP/NPN selectable (with DIP switch 1).

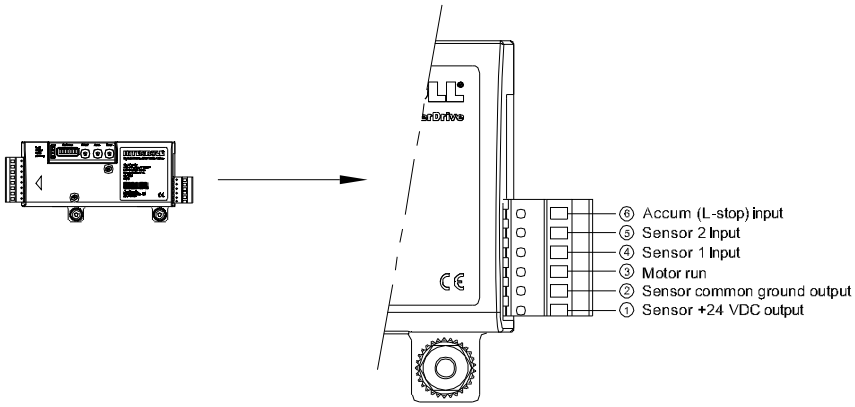
② **Common ground input:** Must be connect to the main power ground.

① **+24 VDC input:** Main power supply 24 VDC (voltage range *see "Technical data", page 17*).

Product information

The 9007 is protected against reverse polarity, but the power supply must provide a short circuit or over current protection and a voltage ripple tolerance of less than 5%.

Sensor connection



⑥ **Accum (L-stop) input:** An active signal (NPN/PNP switchable) on this terminal input will cause the 9007 to accumulate in this zone until the signal is removed. A manual switch or a PLC controller can provide the signal referenced to a common DC ground (NPN) or +24 VDC (PNP). This input is PNP/NPN selectable (with DIP switch 1).

⑤ **Sensor 2 input:** Used as a start sensor. It is located at the upstream edge of the zone and tells the first zone in a conveyor to run. This input is PNP/NPN selectable (with DIP switch 1).

④ **Sensor 1 input:** Located at the downstream edge of the zone. This input is PNP/NPN selectable (with DIP switch 1).

③ **Motor run output:** Output to tell PLC that the motor is running. Unchanged by zone type. This input is PNP/NPN selectable (with DIP switch 1).

② **Sensor common ground output:** Power ground connection for sensor 1 and sensor 2.

① **Sensor +24 VDC output:** +24 VDC power supply for sensor 1 and sensor 2.

Only the sensors mentioned below may be chosen: (sensor supply current from the board is 50 mA max)

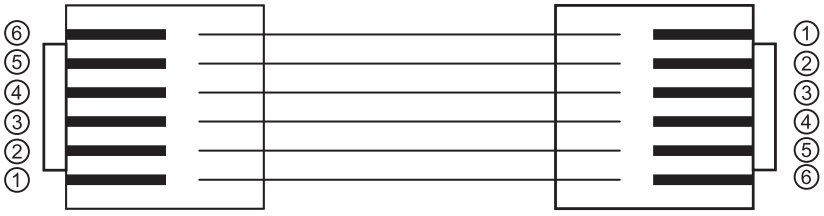
- NPN retro reflective (reflector required) - light operate, normally open (NO) contact
- NPN diffused (no reflector) - dark operate, normally closed (NC) contact
- PNP retro reflective (reflector required) - light operate, normally open (NO) contact
- PNP diffused (no reflector) - dark operate, normally closed (NC) contact

Product information

Peer-to-peer communication

Even though all of the external inputs and outputs are NPN and PNP switchable, the 9007 peer-to-peer communications always use NPN TTL logic.
This means that if a signal passing from board to board is high, it is not in operation. If it is low (grounded), it is either performing its designated function or sending the function signal to a nearby board.

All logic operates from a regulated and filtered 5 VDC power supply on the 9007. The 5 VDC power is delivered by a converter on the board which converts the 24 VDC power that the board receives into 5 VDC for the internal logic and peer-to-peer board communications (For communication cable hardware *see "Accessories", page 46*).



Downstream peer-to-peer

⑥ Jog (I/O) [left]
⑤ Reverse (I/O)
④ Accumulation (I/O)
③ B sensor (OUT)
② Ground
① NPN (IN) [right]

Upstream peer-to-peer

① Jog (I/O) [right]
② Reverse (I/O)
③ Accumulation (I/O)
④ C sensor (IN)
⑤ NPN (IN)
⑥ Ground [left]

While different segments of a system may operate at different input voltages, the DC ground for each system must be held at the same potential (0 VDC) to ensure good operation and clean signals. In other words, when multiple power supplies are used, the DC grounds must always be connected together.

When a peer-to-peer port is connected to another ZPA product, the NPN (in) signal is pulled low except for the case where a 9007 is upstream.

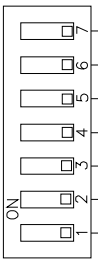
Product information

DIP switches

The DIP switches allow the selection of various types of control operations. The default DIP switch settings are all OFF. This would provide:

- RollerDrive selection of an EC100 (SW6, SW7)
- Standard 9007 connectivity upstream and downstream (SW4, SW5)
- Standard singulate mode (SW3)
- Motor running counter clockwise (SW2)
- All NPN inputs and outputs (SW1)

DIP switch settings are read at reset (power-up) only.



	ON	OFF
SW7: RollerDrive selection	*See chart*	*See chart*
SW6: RollerDrive selection	*See chart*	*See chart*
SW5: Downstream	Jog/Rev ON	Standard
SW4: Upstream	Jog/Rev ON	Standard
SW3: Singulation	Enhanced	Standard
SW2: Rotation	CW	CCW
SW1: Logic	PNP	NPN

	EC100	EC110 GRAY CABLE	EC110 YELLOW CABLE	FUTURE EC120 BLUE CABLE
SW7	OFF	ON	ON	OFF
SW6	OFF	OFF	ON	ON

The following table shows the switch position for different situations:

DIP switch	ON (up position	OFF (down position)
SW5 Downstream	**Jog/Rev ON:** the downstream peer-to-peer cable is connected to another 9007 and the jog/reverse signal is transmitted	**Standard:** the jog/reverse signal is not transmitted
SW4 Upstream	**Jog/Rev ON:** the upstream peer-to-peer cable is connected to another 9007 and the jog/reverse signal is transmitted	**Standard:** the jog/reverse signal is not transmitted
SW3 Singulation	**Enhanced:** enhanced singulated release (*see "Glossary", page 47*) is needed	**Standard:** singulated release (*see "Glossary", page 47*) is needed
SW2 Rotation	**Clockwise:** (rotation of the RollerDrive seen from the cable end)	**Counter clockwise:** (rotation of the RollerDrive seen from the cable end)
SW1 Logic	**PNP:** all external inputs, photoeye inputs and outputs are active high (24 VDC)	**NPN:** all external inputs, photoeye inputs and outputs are active low (0 VDC ground). This excludes the "No fault output" which is always active high (+24 VDC) when in either NPN or PNP mode.

Product information

- Local jog and reverse are always enabled, but upstream and downstream propagation are controlled by DIP switch 4 and DIP switch 5 respectively.
- It is now simple to use DIP switch 4 and DIP switch 5 to define jog/reverse groups, or to defeat jog and reverse completely (recommended whenever not in use).
- If the RollerDrive is mounted with the cable exiting the opposite side of the conveyor frame, switch SW2 has to be set in the opposite position to maintain equal direction of travel.
- For special cases *see "Setting options and wiring diagrams", page 20*

Rotary switches (16 position)

Speed

Position	% of full Speed All motors
F	100
E	96
D	91
C	87
B	82
A	78
9	73
8	69
7	64
6	60
5	55
4	51
3	46
2	42
1	38
0	33

Accel.

Position	% of full Accel. All motors
F	100
E	94
D	87
C	81
B	74
A	68
9	61
8	55
7	48
6	42
5	36
4	30
3	23
2	17
1	10
0	4

Decel.

Position	% of full Decel. EC100	% of full Decel. EC110	% of full Decel. EC120
F	100	100	100
E	35	40	67
D	17	20	33
C	14	16	26
B	11	12	20
A	10	11	18
9	9	10	17
8	8	9	15
7	7	8	13
6	6	7	12
5	5	6	10
4	4	5	8
3	3.5	4	7
2	3	3	5
1	2	2	3
0	1	1	2

Product information

Meaning of the LEDs

The LEDs provide motor, sensor, and jam diagnostics as well as power, fuse, and temperature status. The following table shows the meaning of the LEDs (flashes are ¼ second on, and ¼ second off, in a fixed 4 second time period):

LED	Color	Status	Meaning
Fuse	red	on steady (all other LEDs are off)	Fuse blown
Power	green	on steady	Power ok
Fault	red	on steady	Stalled motor Jam at or between sensors
			Peer-to-peer cable unplugged
		flashing once	Motor or motor cable open or disconnected
		flashing twice	Over-voltage detection 29 VDC ± 0.2 VDC (will cease normal operation)
		flashing three times	Under-voltage detection 19 VDC ± 0.2 VDC (will cease normal operation)
		flashing four times	9007 severe temperature shut-down (will cease normal operation until cool)
		flashing five times	Motor severe temperature shut-down (will cease normal operation until cool)
		flashing six times	Low gain or bad sensor (sensor with fault output connected)
Warning	amber	on steady	Motor current is limited to maximum continuous current due to motor over-temperature
		flashing four times	Motor current is limited to maximum continuous current due to card over-temperature

There is no error output if the amber LED is flashing.

Product information

9007 label

The specifications on the 9007 label are used to identify the 9007. This is required to use the 9007 as intended.

Technical data

Nominal voltage	24 VDC
Voltage range	22 to 26 VDC
Voltage ripple tolerance	< 5%, < 1% recommended
Continuous current	EC100: 1.8 A EC110: 2.4 A EC120: 2.5 A
Peak current	EC100: 4.1 A EC110: 5.1 A EC120: 5.1 A
Fuse	5 A slow blow Littelfuse 0452005
Protection classification	IP20
Ambient temperature for operation	0 °C to 40 °C (32 °F to 104 °F)
Ambient temperature for transport and storage	-20 °C to 75 °C (-4 °F to 167 °F)
Ambient temperature changes	max. 1 °K/min; 3 h; two cycles according to IEC 68-2-14
Ambient humidity	max. 90% not condensing

Product information

Speed settings

On board speed setting

The speed can be continuously adjusted (between 100% and 33% for the EC100, EC110, and EC120) by the rotary switch marked "speed" on the 9007. Default setting is maximum.

Gear ratio	Speed range			
	EC100 + 9007 (1.9" diameter)	EC110 + 9007 (1.9" diameter)	EC110 + 9007 (2.5" diameter)	Future EC120 (2.5" diameter)
4:1	--	2.41 to 0.80 m/s (475 to 157 fpm)	--	--
9:1	--	1.07 to 0.36 m/s (211 to 70 fpm)	--	--
12:1	1.32 to 0.44 m/s (260 to 86 fpm)	0.8 to 0.26 m/s (158 to 52 fpm)	1.05 to 0.35 m/s (207 to 69 fpm)	--
16:1	1.03 to 0.34 m/s (202 to 67 fpm)	0.6 to 0.20 m/s (119 to 39 fpm)	0.78 to 0.26 m/s (154 to 51 fpm)	--
24:1	0.69 to 0.23 m/s (135 to 45 fpm)	0.4 to 0.13 m/s (79 to 26 fpm)	0.52 to 0.17 m/s (103 to 34 fpm)	--
36:1	0.44 to 0.15 m/s (88 to 29 fpm)	0.27 to 0.09 m/s (53 to 17 fpm)	0.35 to 0.12 m/s (69 to 23 fpm)	0.26 to 0.09 m/s (52 to 17 fpm)
48:1	0.35 to 0.11 m/s (68 to 22 fpm)	0.2 to 0.07 m/s (40 to 13 fpm)	0.26 to 0.09 m/s (51 to 17 fpm)	0.20 to 0.07 m/s (39 to 13 fpm)
64:1	0.25 to 0.08 m/s (50 to 16 fpm)	0.15 to 0.05 m/s (30 to 10 fpm)	--	0.15 to 0.05 m/s (29 to 10 fpm)
96:1	0.17 to 0.06 m/s (34 to 11 fpm)	--	--	0.10 to 0.04 m/s (20 to 7 fpm)

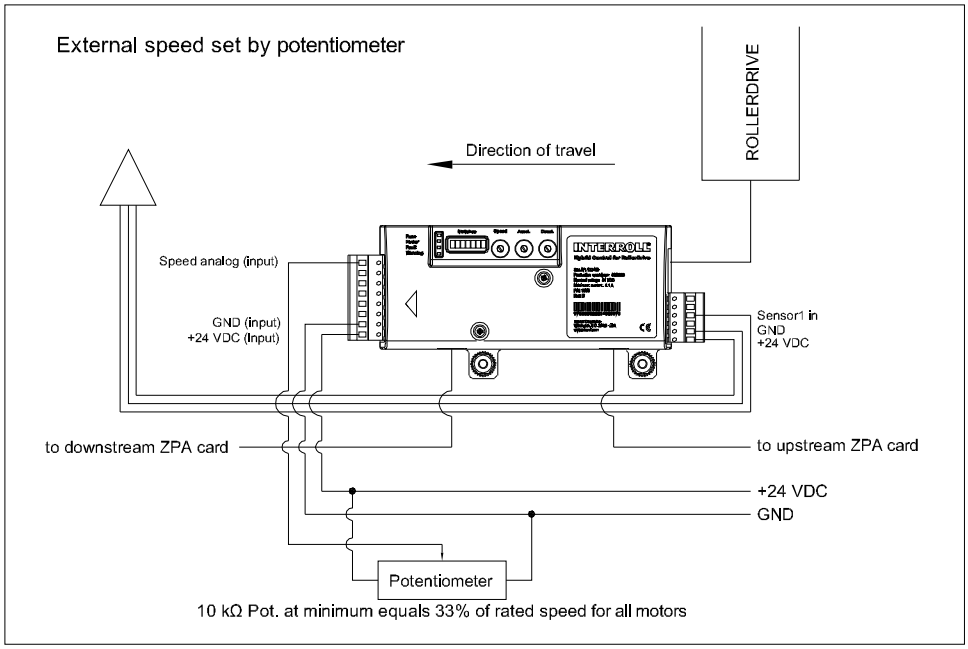
If more than one 9007 has to run with reduced speed, it is recommended to set the speed externally (by PLC or external potentiometer; *see "External speed setting", page 19*).

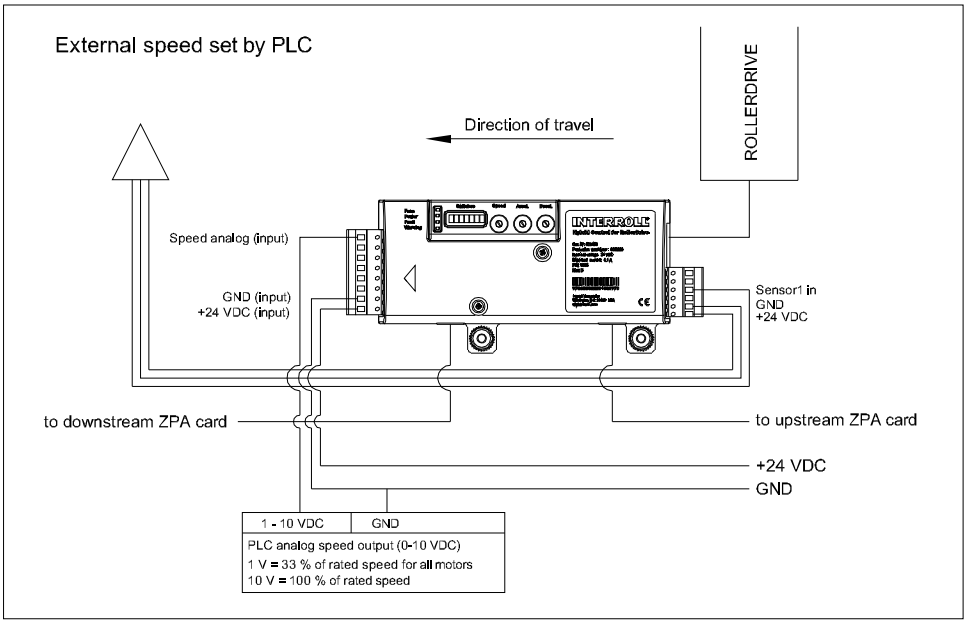
Product information

External speed setting

Apart from the rotary switch on the 9007, there are other ways to set the speed.

For the meaning of the settings *see "DIP switches", page 14*.





Product information

Setting options and wiring diagrams

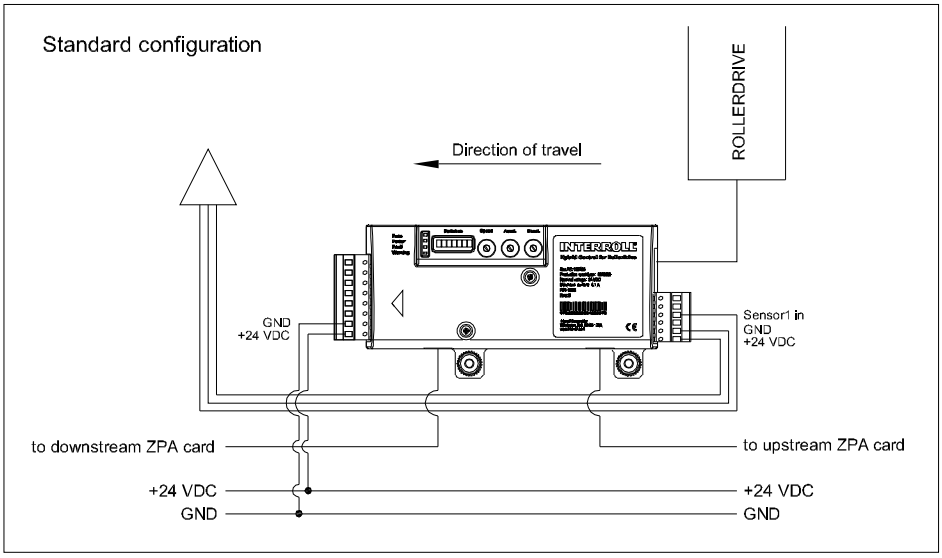
This chapter explains the DIP switch settings for different application

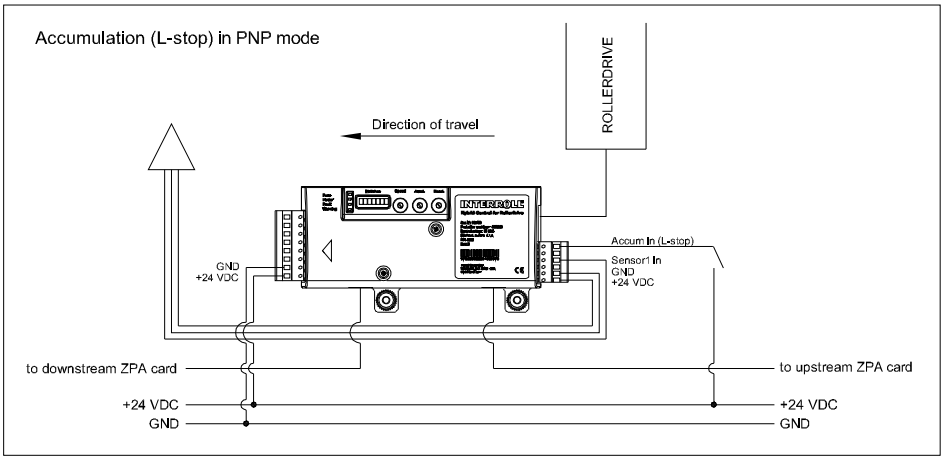
When the DIP switch settings ON / OFF are stated, both settings are possible for the shown wiring (for the meaning of the settings *see "DIP switches", page 14*).

9007 is between two 9007 Cards

Upstream device		**9007**		
Downstream device		**9007**		
DIP switch 4	**Off**	**On**	**Off**	**On**
DIP switch 5	**Off**	**On**	**On**	**Off**
Upstream peer-to-peer jog/ reverse	Disabled	Functional	Disabled	Functional
Downstream peer-to-peer jog/reverse	Disabled	Functional	Functional	Disabled
Zone type	ZPA-mode	ZPA-mode	ZPA-mode	ZPA-mode
Smart 1 (in)	Jog	Jog	Jog	Jog
Reverse (in)	System reverse	System reverse	System reverse	System reverse
Smart 1 (out)	Motor run	Motor run	Motor run	Motor run
Sensor 2	Another C sensor	Another C sensor	Another C sensor	Another C sensor

Product information

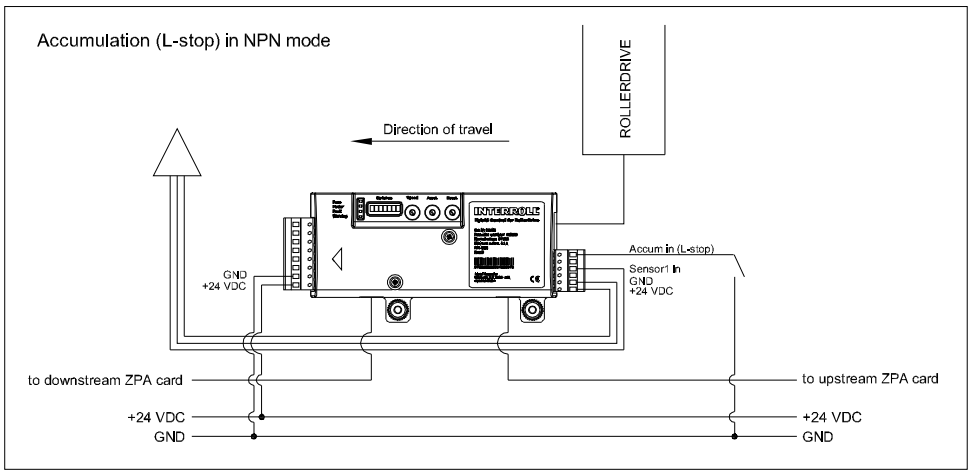




DIP switch settings:

- SW1: ON

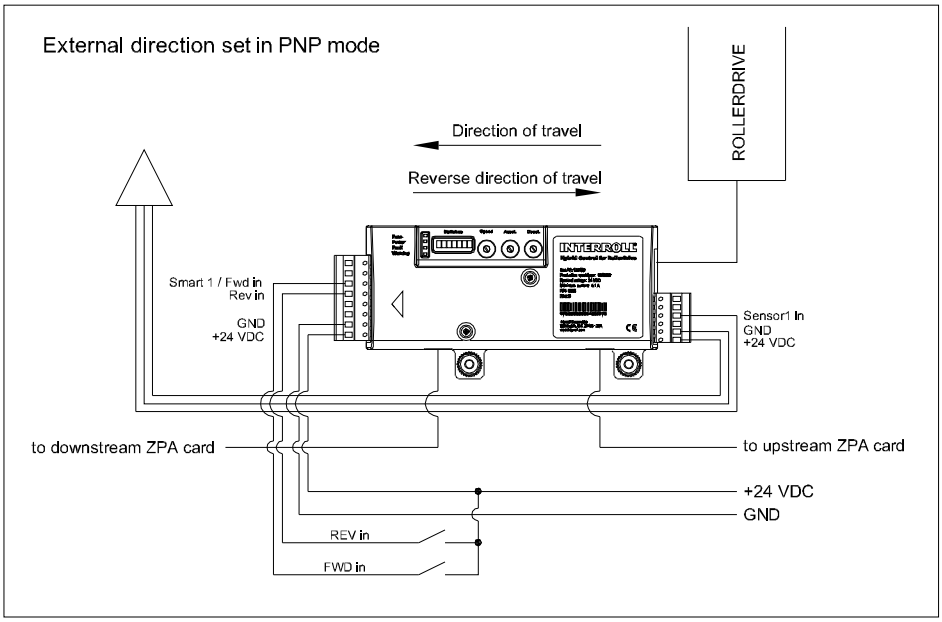
Product information



DIP switch settings:

- SW1: OFF

Product information



DIP switch settings:

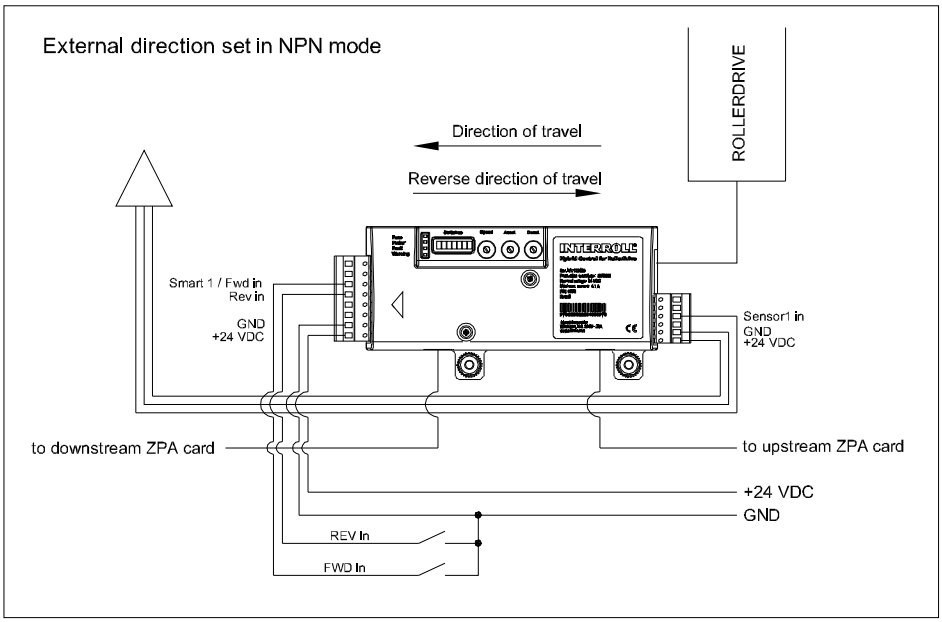
- If SW5 is ON, direction setting is transferred downstream.
- If SW4 is ON, direction setting is transferred upstream.
- SW1: ON

Start options:

- FWD connected to 24 VDC at PNP mode causes ccw rotation.
- REV connected to 24 VDC at PNP mode causes cw rotation.
- FWD and REV connected to 24 VDC at PNP mode causes coast mode.

- FWD signal acts like a jog signal, disregarding ZPA functionality and photoeye signals.
- REV signal reverses motor and logic direction; upstream becomes downstream and C sensor becomes B sensor.

Product information



DIP switch settings:

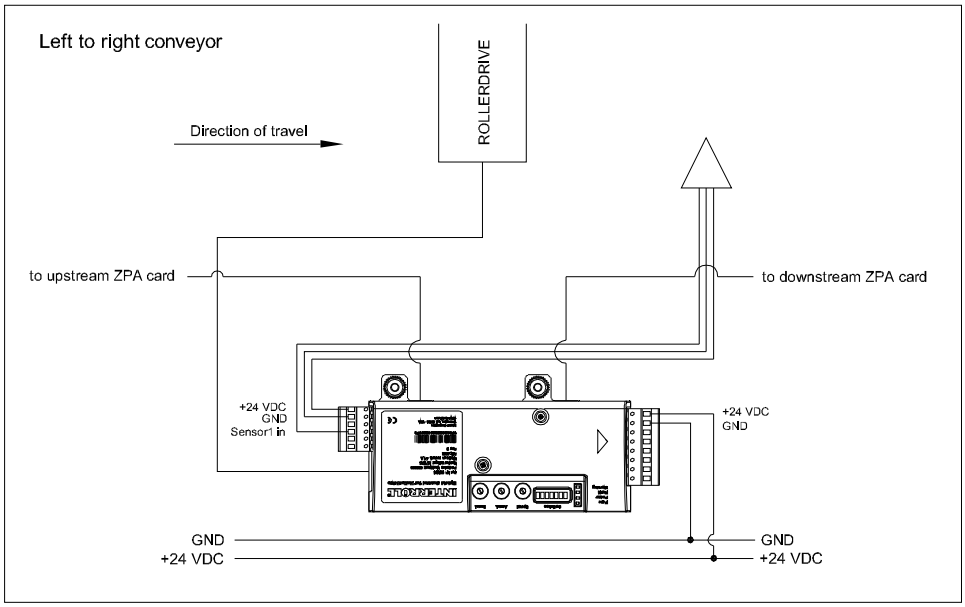
- If SW5 is ON, direction setting is transferred downstream.
- If SW4 is ON, direction setting is transferred upstream.
- SW1: OFF

Start options:

- FWD connected to GND at NPN mode causes ccw rotation.
- REV connected to GND at NPN mode causes cw rotation.
- FWD and REV connected to GND at NPN mode causes coast mode.

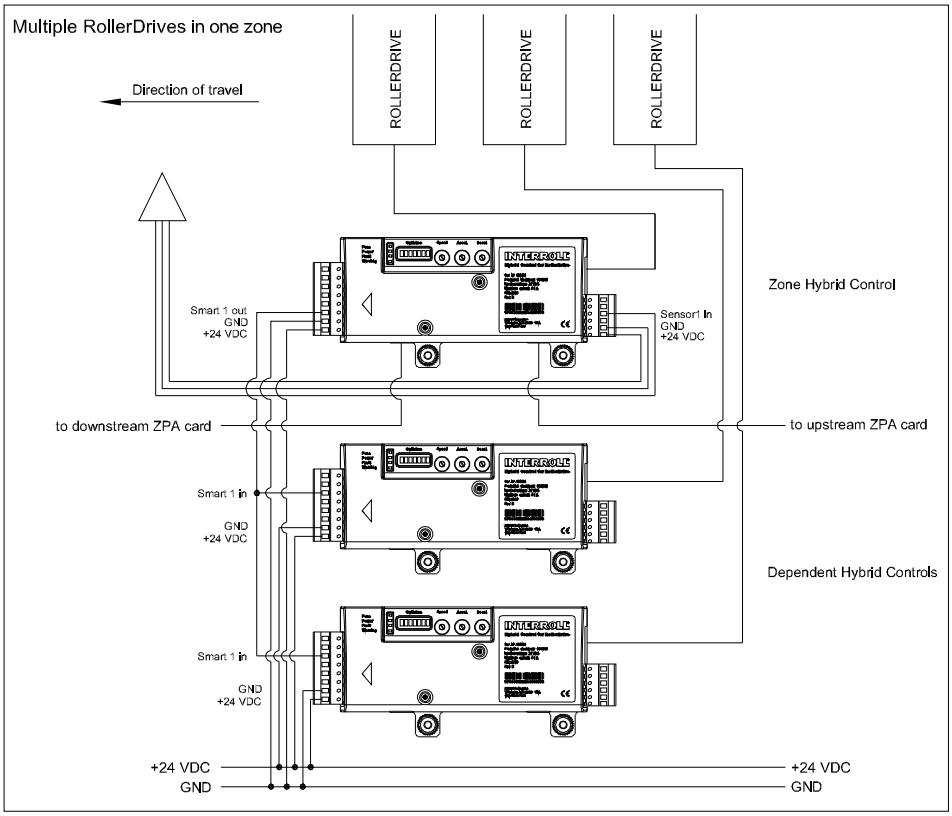
- FWD signal acts like a jog signal, disregarding ZPA functionality and photoeye signals.
- REV signal reverses motor and logic direction; upstream becomes downstream and C sensor becomes B sensor.

Product information



Works like a standard configuration, only the 9007 is turned upsidedown.

Product information

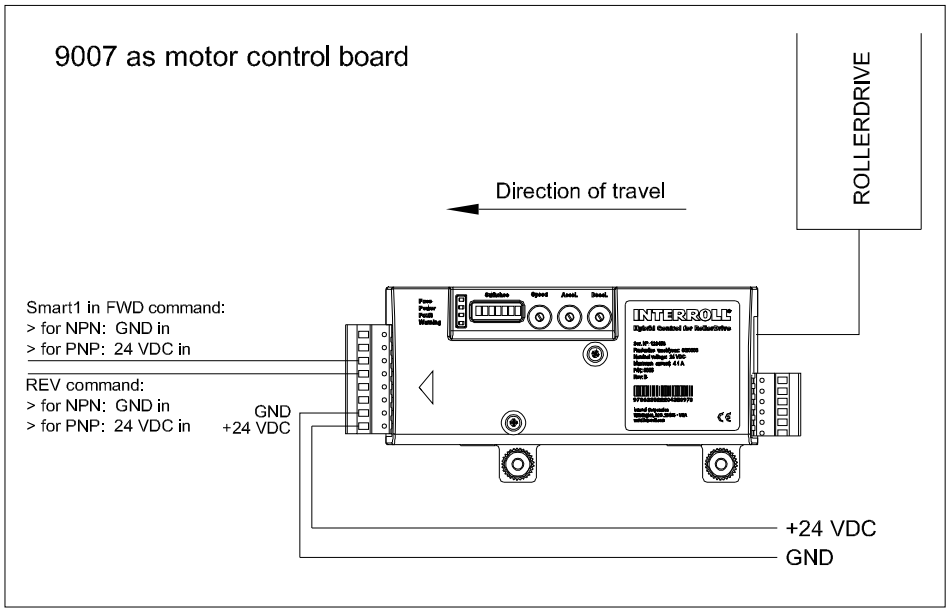


A reverse command to the Zone 9007 will not be communicated to the dependent 9007 cards.

Dependent 9007 DIP switch settings:

- SW1: Must have the same switch setting as zone 9007 (logic mode NPN or PNP).

Product information



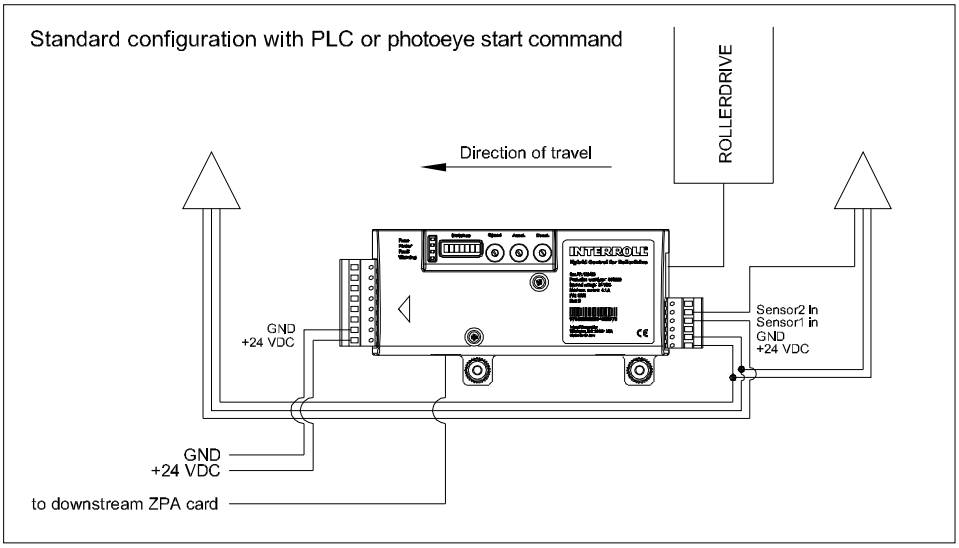
Start options:

- FWD connected to 24 VDC causes ccw rotation.
- REV connected to 24 VDC causes cw rotation.
- FWD and REV connected to 24 VDC causes coast mode.

Product information

9007 is entry zone

Upstream device	-	-	-	-
Downstream device		**9007**		
DIP switch 4	**Off**	**On**	**Off**	**On**
DIP switch 5	**Off**	**On**	**On**	**Off**
Upstream peer-to-peer jog/ reverse	Disabled	Functional	Disabled	Functional
Downstream peer-to-peer jog/reverse	Disabled	Functional	Functional	Disabled
Zone type	Smart I/O entry	ZPA-mode	Smart I/O entry	ZPA-mode
Smart 1 (in)	Request	Jog	Request	Jog
Reverse (in)	System reverse	System reverse	System reverse	System reverse
Smart 1 (out)	Perm.	Motor run	Perm.	Motor run
Sensor 2	Not used (smart I/O)	Another C sensor	Not used (smart I/O)	Another C sensor



DIP switch settings:

- SW4: ON / OFF (specifies if this zone is a transport or entry zone; if sensor 2 IN is used, SW4 must be set to ON)

Sensor 2 IN start signal (by PLC or photoeye):

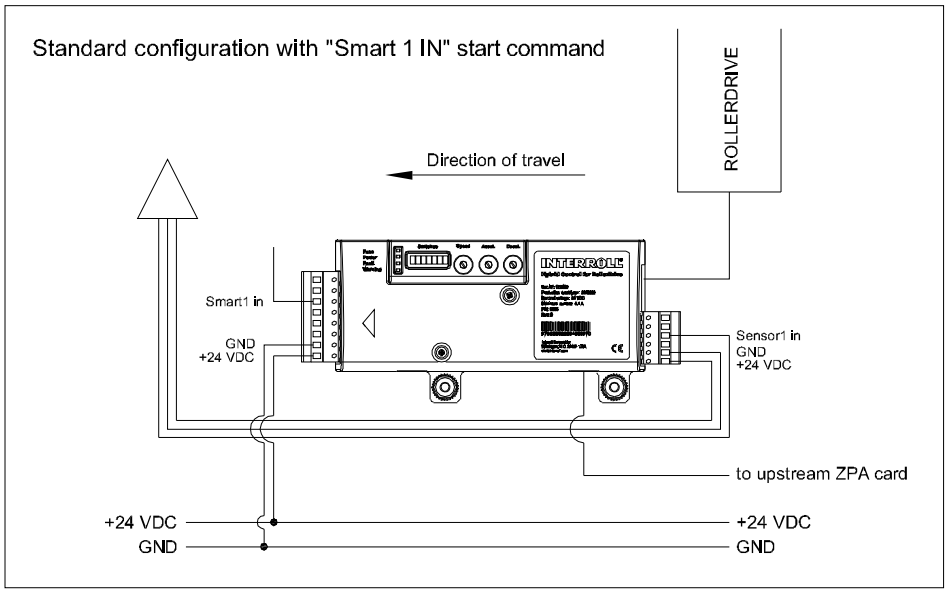
- Start signal for PNP: 24 VDC
- Start signal for NPN: GND

If you are using a photoeye as a starting signal, connect sensor 2 IN with the photoeye.

Product information

9007 is exit zone

Upstream device		**9007**		
Downstream device	**-**	**-**	**-**	**-**
DIP switch 4	**Off**	**On**	**Off**	**On**
DIP switch 5	**Off**	**On**	**On**	**Off**
Upstream peer-to-peer jog/ reverse	Disabled	Functional	Disabled	Functional
Downstream peer-to-peer jog/reverse	Disabled	Functional	Functional	Disabled
Zone type	Smart I/O exit	ZPA-mode	ZPA-mode	Smart I/O exit
Smart 1 (in)	Perm.	Jog	Jog	Perm.
Reverse (in)	System reverse	System reverse	System reverse	System reverse
Smart 1 (out)	Request	Motor run	Motor run	Request
Sensor 2	Another C sensor	Another C sensor	Another C sensor	Another C sensor



DIP switch settings:

- SW5: ON / OFF (specifies if this zone is a transport or exit zone)

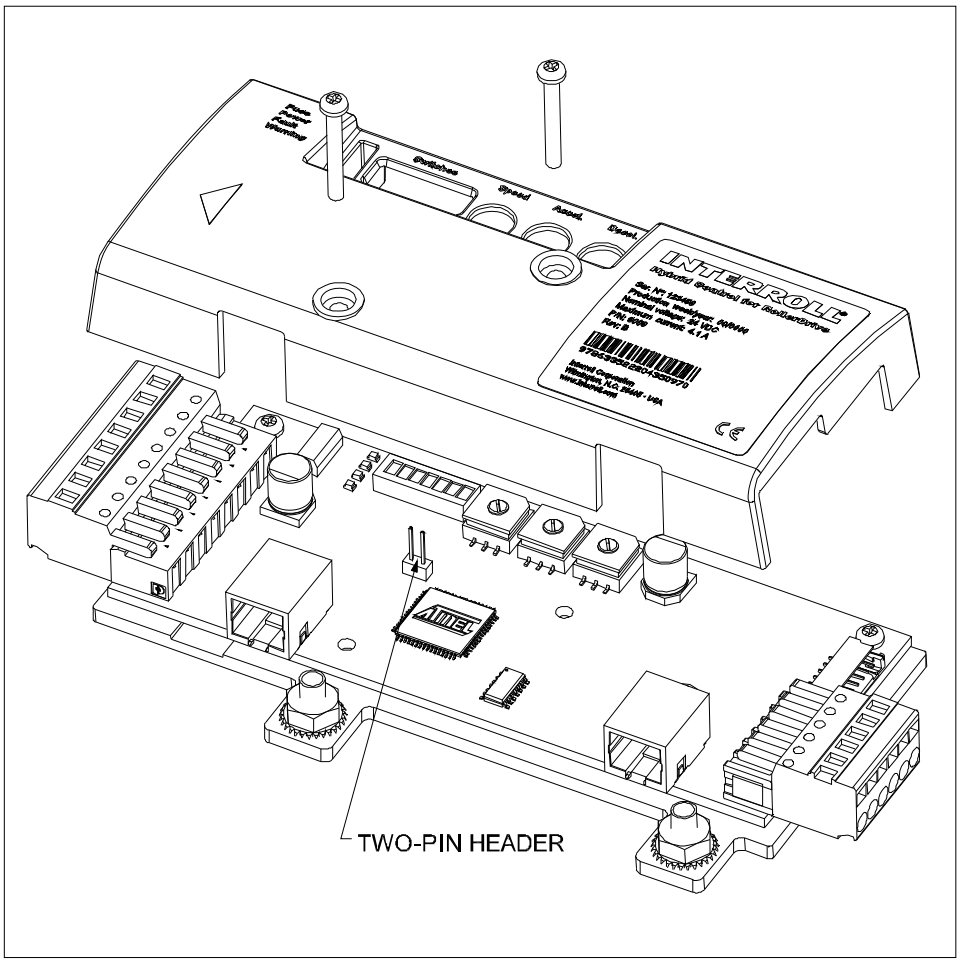
Smart 1 IN signal (by PLC or photoeye):

- Start signal for PNP: 24 VDC
- Start signal for NPN: GND

Product information

Learn Mode Reset

At startup "Learn Mode" automatically sets the zone length, and saves it, simply by running an object from the upstream sensor to the downstream sensor. If the sensor positioning or zone length should change after startup, you must reset the learn mode. Simply remove the two screws from the cover to reveal the two pin header shown below. **Carefully** short these two pins together until you see the LED's flash. **Immediately** remove the short. You are now ready to run an object from the upstream sensor to the downstream sensor to "re-learn" the zone length.



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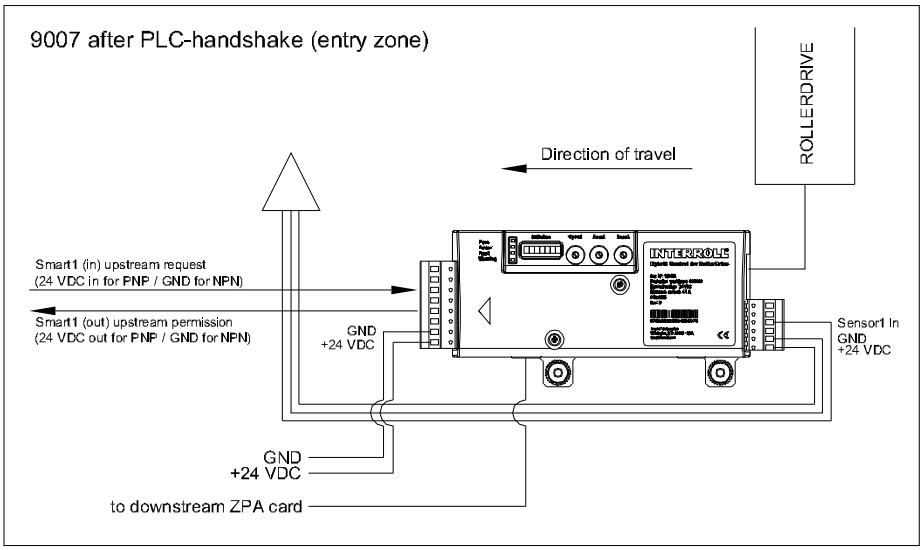
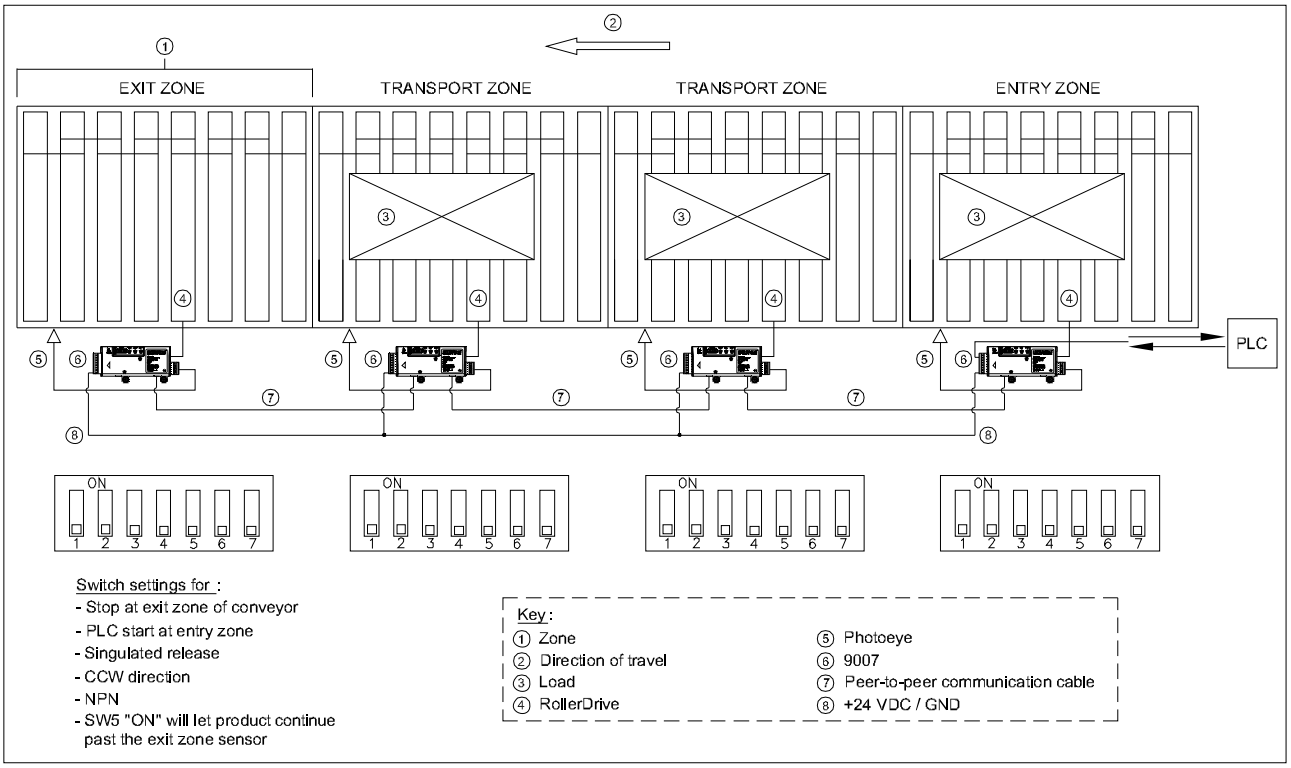
Product information

9007 in conjunction with PLC-handshakes	9007 after PLC-handshake (entry zone)		9007 before PLC-handshake (exit zone)		9007 between PLC-handshakes
Upstream device	**PLC**	**PLC**	**9007**	**9007**	**PLC**
Downstream device	**9007**	**9007**	**PLC**	**PLC**	**PLC**
DIP switch 4	**Off**	**Off**	**Off**	**On**	**Off**
DIP switch 5	**Off**	**On**	**Off**	**Off**	**Off**
Upstream peer-to-peer jog/reverse	Disabled	Disabled	Disabled	Functional	Disabled
Downstream peer-to-peer jog/ reverse	Disabled	Functional	Disabled	Disabled	Disabled
Zone type	Smart I/O entry	Smart I/O entry	Smart I/O exit	Smart I/O exit	Smart I/O dependent
Smart 1 (in)	Request	Request	Perm.	Perm.	Run
Reverse (in)	System reverse	System reverse	System reverse	System reverse	System reverse
Smart 1 (out)	Perm.	Perm.	Request	Request	B sensor
Sensor 2	Not used (smart I/O)	Not used (smart I/O)	Another C sensor	Another C sensor	Not used

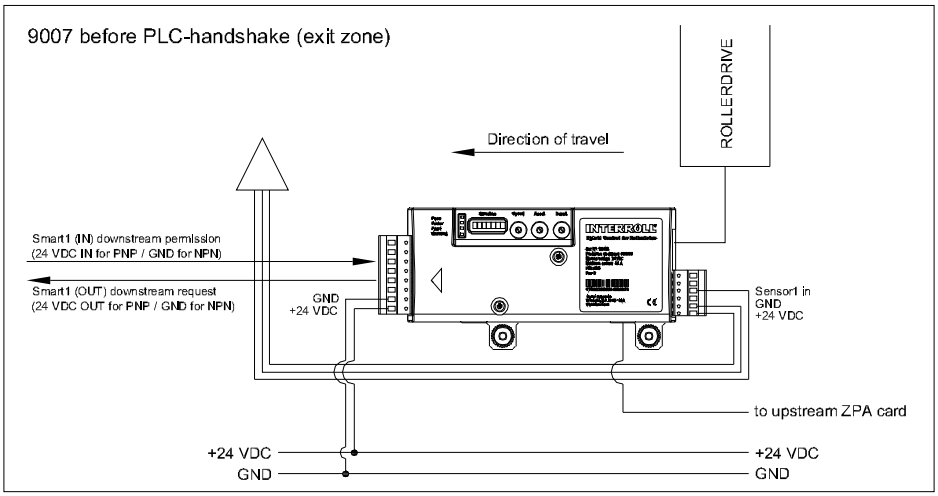
Product information



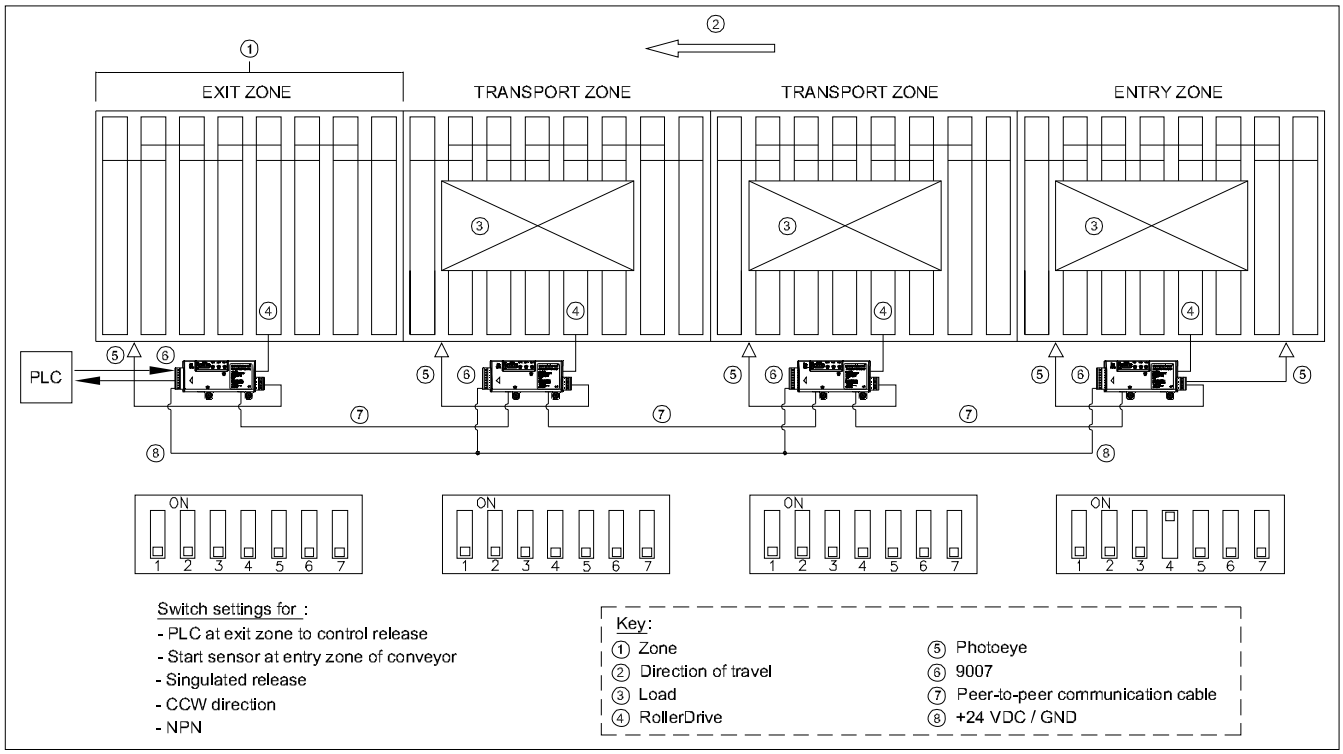
- A smart I/O based handshake is required at the interface
- DIP switch 4 must be OFF to make this zone into an entry zone
- Jog and reverse are enabled only if DIP switch 5 is ON



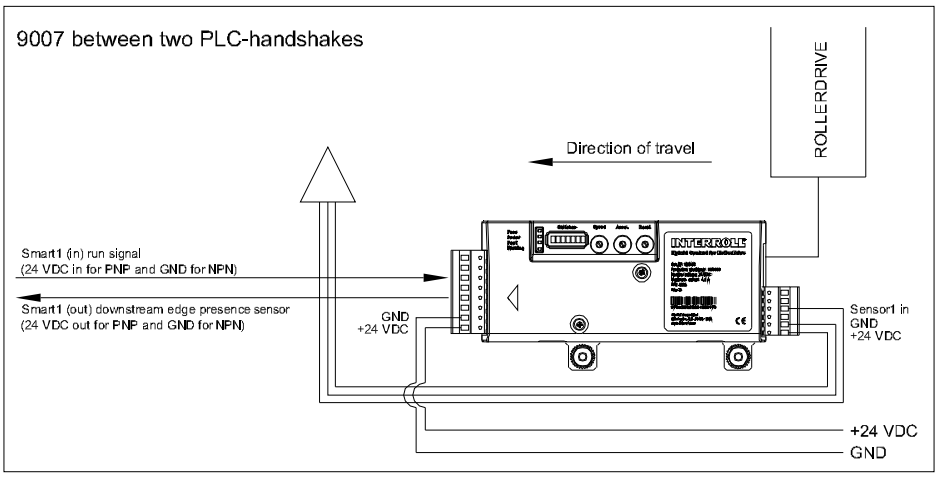
Product information



- A smart I/O based handshake is required at the interface
- DIP switch 5 must be OFF to make this zone into an exit zone
- Jog and reverse are enabled only if DIP switch 4 is ON



Product information



- A smart I/O based handshake is required at both interfaces
- DIP switch 4 and DIP switch 5 must both be OFF to make this zone into a dependent zone.

Transport and storage

Transport

- Each 9007 is packed in its own carton case.

⚠ CAUTION

Risk of injury due to improper transport

- ➢ Transport may only be carried out by qualified and authorized persons.
- ➢ Observe the following notices.

- ➢ Do not stack more than four carton boxes.
- ➢ Check the fixation of the 9007 before transport.
- ➢ Avoid hard shocks during transport.
- ➢ Check each 9007 visually for damage after transport.
- ➢ In case of damage, take photos of the damaged parts.
- ➢ To maintain the warranty, instantly report any damage caused during transport to the transport company and to Interroll.
- ➢ Do not transfer the 9007 between warm and cold environments as this may cause condensing water.

Storage

⚠ CAUTION

Risk of injury due to improper storage

- ➢ Do not stack more than four carton boxes.

- ➢ Check each 9007 for damage after storage.

Assembly

Warning notices concerning assembly

NOTICE

Risk of damage leading to failure or shortened life expectancy of the 9007

➢ Observe the following notices.

- ➢ Do not drop or mishandle the 9007 to avoid internal damage.
- ➢ Check each 9007 visually for damage before assembly.

Warning notices concerning the electrical installation

NOTICE

Risk of damage to the 9007

➢ Observe the following notices.

- ➢ The electrical installation may only be executed by qualified and authorized persons.
- ➢ Disconnect the power before installing, removing or rewiring the 9007.
- ➢ Do not apply AC current to the RollerDrive or 9007 device at any time as this will cause irreparable damage.
- ➢ Do not apply too much stress to the connector pins. Bending the wires at the connector can cause damage to the insulation of the wires, which could result in failure of the 9007 or the RollerDrive.
- ➢ Ensure that the RollerDrive, the 9007 and the 24 VDC power source are properly earthed through the frame or supporting structure in which the RollerDrive and the 9007 are installed. Failure to do so could cause the buildup of static electricity or ground loops and can cause the motor or 9007 to malfunction or fail prematurely.
- ➢ Do not spin the RollerDrive manually, as this generates an induction voltage which could damage the 9007.

Assembly

Installing the 9007 Hybrid Control in a conveyor system

- Use the 9007 as a template and mark the center of the two mounting holes. For the distance between the holes, *see "Dimensions", page 7*.
- Drill two ø 5.6 - 6 mm (0.22 - 0.24 in) mounting holes at the marked spots.
- Insert the button head screws in the holes on the opposite side the 9007 is to be mounted.
- Install the 9007 to the frame with the screws protruding through the mounting holes.
- Slip the nuts to the screws and tighten.
- Ensure that there is a ground path between the 9007 and the conveyor frame it is mounted to.

The 9007 and conveyor frame should be at the same potential referenced to earth ground.

Electrical installation

The connector supplied with the RollerDrive EC1xx mates up with the header on the 9007.

The connectors "Power input and I/O terminal" and "Sensor connection" are cage clamp terminals.

- To actuate the cage clamp, use the supplied tool or insert a small screwdriver.
- Plug in the RollerDrive connector.
- Plug in the peer-to-peer connection cable, if applicable.

Initial startup and operation

Initial startup

Inspections before initial startup

- Ensure that all bolts are tightened according to the specifications.
- Ensure that no additional dangerous areas arise due to interfaces with other components.
- Ensure that the wiring is in accordance with specifications and legal guidelines.
- Check all protection devices.
- Ensure that no bystanders are in dangerous areas around the conveyor.

Operation

NOTICE

Damage to the 9007 or the motor of the RollerDrive due to induction

- Do not push items along the roller conveyor by hand.
- Do not spin the RollerDrive manually.

Inspections before every startup

- Check the position of the DIP switches (*see "DIP switches", page 14*).
- Check the speed settings at the speed rotary switch. It is recommended to run the RollerDrive at maximum speed.
- Check the 9007 for visible damage.
- Check all protection devices.
- Ensure that no bystanders are in dangerous areas around the conveyor.
- Clearly specify and monitor the way goods are placed on the conveyor.

Changing settings

- To reduce the speed manually, turn the rotary switch counterclockwise with a small screwdriver.
- To increase the speed manually, turn the rotary switch clockwise with a small screwdriver.
- To set the DIP switches, carefully use a small screwdriver.

Procedure in case of accident or malfunction

- Stop the conveyor at once and ensure that it cannot be started accidentally.
- In case of an accident: Provide first aid and call for emergency assistance.
- Inform responsible persons.
- Have the malfunction repaired by qualified persons.
- Start the conveyor only after this has been approved by qualified persons.

Maintenance and cleaning

Warnings concerning maintenance and cleaning

⚠ CAUTION

Risk of injury due to improper handling or accidental motor starts

- Maintenance work and cleaning may only be executed by qualified and authorized persons.
- Only perform maintenance work after switching off the power. Ensure that the 9007 cannot be turned on accidentally.
- Set up signs indicating maintenance work.

Maintenance

Checking the 9007

The 9007 must be checked at regular intervals to avoid malfunctions.

- Monthly check the 9007 and its leads for visible damage.
- Annually ensure that the screws of the 9007 are still tight and that the cables are still laid properly and connected to the terminals.

Replacing the 9007

If a 9007 is damaged, it has to be replaced.

- Install a new 9007 (*see "Abandonment", page 45* and *see "Assembly", page 37*).

Replacing fuse

- Carefully use tweezers to remove and insert the fuse. Ensure you do not damage the fuse holder, the circuit board or its devices.

Cleaning

Dust and dirt in combination with humidity may bridge the electric circuit. Therefore, in a dirty environment, periodic cleaning will help to avoid short-circuits which could damage the 9007.

- Regularly blow off dust and dirt by using low compressed air.

Troubleshooting

Error search

When troubleshooting the conveyor system, keep in mind that each 9007 controls a zone. If a problem exists in a zone or a section of zones, the symptoms might exist either in the zone or in the neighboring zone.

Keep in mind that information travels downstream. The cause of most control problems can be found upstream.

Symptom	Possible cause	Help
System is not operating	No power supply	Check whether the output voltage of the power supply is within the specified voltage range.
	Wrong polarity of the bus line inputs	Verify the polarity of the bus line inputs to the 9007 (*see "Inputs and outputs", page 11*).
	Wrong position of the DIP switch 1	Verify that the position of the DIP switch 1 Logic (NPN or PNP) matches the sensor type (*see "DIP switches", page 14*).
	Fuse is blown	Replace the fuse (*see "Replacing fuse", page 40*).
Zone runs without package	Wrong sensor output	Check the type of sensor output (*see "Sensor connection", page 12*).
	Wrong alignment of sensors	Verify the alignment of the sensors. Align the photoeyes to see the conveyor field only, no overhead lights, side frames, etc.
	Jog command by an inadvertently grounded Smart 1 / FWD input command	Check the connection of Smart 1 / FWD input
	Communication cable is twisted or defective	Check the communication cable upstream
	Photoeye is not connected properly	Check the connection of the photoeye to 9007. Verify the photoeye pin assignment (*see "Sensor connection", page 12*).
	Photoeye is damaged	Replace the photoeye.
	If the zone continues to run without any communication cables connected and no photoeye input, 9007 is damaged.	Replace 9007. Assembly of the 9007 *see "Assembly", page 37*.

Troubleshooting

Symptom	Possible cause	Help
Multiple zones run continuously	Communication cable is defective, sending a jog command	Find the farthest zone in the upstream direction that is running continuously. Check the communication cables of this zone.
	Different ground of a multiple power supply	Verify that a common ground is shared by all supplies.
System reverses or jogs without prompting	Fuse is blown If DIP switch 4 and 5 are ON for all cards, a blown fuse or loss of power in one 9007 sends a reverse jog command to all 9007 cards in the system.	Check the fuses in all 9007 cards of the system and replace the blown one (*see "Replacing fuse", page 40*).
	Miswired communication cable	Check the communication cables in the entry zone of the system. Replace the miswired cables.
Zone stops when package arrives Zone does not accept package	Zone receives the accumulate signal	Check that the zone is not receiving the accumulate signal from the downstream zone. Ensure that there is no jumper installed from ground to the Accum (L-stop) input terminal on the 9007 of the zone where the package stops. If a switch is used instead of a jumper, check that the switch is off.
	Communication cable to or between the zones is miswired	Check the communication cables and replace them if they are miswired.
	No power supply of the 9007	Check the power input to 9007
	No power supply of the RollerDrive EC1xx	Verify that the motor wires are terminated properly.
	Communication cable is miswired between the zone that is operating and the zone that is not	Replace the cable.
Package stops within a zone	Photoeye is not aligned properly	Check the alignment of the photoeye.
	Speed of the RollerDrive EC1xx is too slow	Calculate the speed and the distance to ensure the time limit is not exceeded.
		Reset "Learn Mode" *(see "Learn Mode Reset, page 30)*
	Jammed package	Remove jammed packages.
	Jammed roller	Remove the cause of the jam or replace the roller.

Troubleshooting

Symptom	Possible cause	Help
Package coasts into the next zone instead of stopping immediately	Package is heavy or has a low coefficient of friction	Move the photoeye further back into the zone. Apply a coating that increases the friction between the rollers and the packages.
Zone does not reverse	Communication cable to upstream zone is miswired	Replace the communication cable.
	Signal has not been sent and received properly	Check the output of the upstream 9007 and the input to the 9007.
	Different ground of the zones	Check that a common ground exists between both zones.
System turns off when several zones are in use at the same time	Power supply is not sufficient	Ensure that the 24 VDC power supply has adequate power for the system requirements. Check that the AC voltage source and DC voltage power supply are installed correctly.
9007 does not recognize the start sensor	Sensor and reflector are not aligned properly	Check the alignment of the sensor and reflector. Check the settings of DIP switch 4 and 5.
RollerDrive EC1xx is not in braking mode without any packages on the conveyor system	This is not an error. It is a power-saving feature. The RollerDrive EC1xx is in coast mode until it is commanded to run or accumulate.	

Troubleshooting

The following errors are reported by illuminated LEDs:

(also *see "Meaning of the LEDs", page 16*)

Symptom	Possible cause	Help
Motor is in brake mode, red fault LED flashes once and error output is active ("No fault output" is active).	Invalid state of motor hall effect sensor • Broken wire • Failed hall effect sensor	Replace the RollerDrive.
	Voltage over or under limits • Power supply fluctuations, failure or overload condition	Check the power supply.
On a decline, motor is in brake mode momentarily. Red fault LED flashes twice ("No fault output" is active) or power supply shutdown or fuse blown on card.	Overvoltage detection (caused by over speed or excessive back EMF) • decline angle too high • package weight too high	• Reduce decline angle • Use brake roller to keep speed low
	Motor overrun, overset speed • Package enters zone at a higher than anticipated speed	Reduce the package entry speed.
Red fault LED flashes six times and error output is active ("No fault output" is active).	Low gain signal from sensor • Dirty sensor lens or misaligned	Clean the sensor lens and align the sensor.
Current folds back to maximum continuous current, amber fault LED is on.	Card or motor over temperature • Excessive load or duty cycle	Reduce the load of packages or throughput of the zone
Current folds back to approximately 1.5 A while applying consistent torque. Red fault LED is onand error output is active ("No fault output" is active).	Motor stall condition • Obstruction or load too heavy to be conveyed	Once the stall condition is removed, the RollerDrive will resume normal operation.

Abandonment and disposal

Abandonment

⚠ CAUTION

Risk of injury due to improper handling

- Abandonment may only be executed by qualified and authorized persons.
- Only abandon the 9007 after switching off the power. Ensure that the 9007 cannot be turned on accidentally.

- Disconnect all cables from the 9007.
- Unscrew the screws attaching the 9007 to the conveyor frame.
- Extract the 9007 from the conveyor frame.

Disposal

The operator is responsible for the proper disposal of the 9007. In doing so, industry-specific and local provisions must be observed for the disposal of the 9007 and its packaging.

Appendix

Accessories

Plugs and cables

Part	Description
Power and I/O plug	• 8-pin cage clamp type connector, Wago part # 231-308/026-004 • Wire diameter: – Minimum 0.08 mm^2 (AGW 28) – Maximum 2.5 mm^2 (AGW 12)
Sensor plug	• 6-pin cage clamp type connector, Wago part # 734-106/000-004 • Wire diameter: – Minimum 0.08 mm^2 (AGW 28) – Maximum 1.5 mm^2 (AGW 14)
Peer-to-peer cable (parts)	• Cable: 6 pos flat cable, Digikey part # A0063R • Two plugs: 6 pos modular connector plug, Digikey part # A9093-ND • Conductor Size AWG: 26 • Assembly tool: AMP part # 2-231652-8
Peer-to-peer cable (preassembled)	• Complete cable: 6 pos flat cable, with (2) 6 pin modular plugs, Digikey part # A1663R-03-ND (03 = 3 foot length) • www.digikey.com
Motor plug	• The motor plug for the RollerDrive consists of a plug and terminal pins – Plug: AMP part # 175778-8 – Terminal pins: AMP part # 1-175102-1 • Crimping tool AMP part # 9184381

Appendix

Glossary

Back EMF — Electromotive force (voltage) generated by a package arriving at high speed at a powered RollerDrive under no load prior to the package's arrival. EMF is a counter-voltage phenomenon that is always present in a motor. Excessive back EMF can cause a current backlash that may damage the 9007 or power supply. Care should be taken to minimize excessive back EMF by minimizing the speed differences between the gravity conveyor and/or different zones of powered conveyor sections.

B sensor — Downstream edge presence sensor of own zone

C sensor — Downstream edge presence sensor of upstream zone

Coast mode — The RollerDrive is running freely without power or braking.

DIP switch 4 — Affects upstream peer-to-peer propagation of speed, jog and reverse signals for certain scenarios.

DIP switch 5 — Affects downstream peer-to-peer propagation of speed, jog and reverse signals for certain scenarios.

Downstream — Normally this is the zone to the left of another given zone. The reference is always that packages move from upstream to downstream.

Dynamic braking — For DC motors, dynamic braking is a method of stopping a motor by applying a resistive load across the motor winding leads after disconnection from the DC supply. The motor operates as a generator. By its nature, dynamic braking has no holding power by itself, i.e. the motor can still be rotated by outside forces. Interroll has added zero motion hold to achieve this.

EC1xx — Short form for Interroll 24 VDC brushless RollerDrive versions:
- EC100
- EC110
- EC120

Edge full — Also referred to as "product waiting". It indicates that an upstream zone has a product at its downstream edge sensor waiting to be moved into the next downstream zone. Edge full is a signal transmitted across the peer-to-peer cable used by the 9007 for zone-to-zone communication.

Enhanced Singulated release — Also called wave release. A method of release which allows the upstream release of a package as soon as the downstream package blocks the photoeye of the downstream zone with its leading edge. This dramatically increases throughput over singulated release but can sometimes result in lost packages. There is also a short delay that is propagated upstream to eliminate all packages starting at the exact same time.

Foldback current — Maximum allowable current is decreased by the 9007.

Appendix

Idler rollers	Non-powered rollers attached to a RollerDrive typically via O-rings or multi-rip belts.
Jam protection	A method of protecting packages that are possibly jammed in a zone. If the 9007 detects a jam or obstruction at the downstream end of the zone, it sends an accumulation signal to the upstream zone preventing a buildup of accumulation pressure.
Jog	RollerDrive runs continuously as long as the command is set. If jog mode is activated, the 9007 disregards ZPA or photoeye signals.
N/C	No care; affects nothing
NPN-override	DIP switch 4 is for upstream, DIP switch 5 is for downstream.
O-rings	O-rings made of materials such as polyurethane that connect RollerDrives to their associated idler rollers.
Perm	Permission: Signal to upstream zone to discharge zone (send load).
Photoeye	An ON/OFF sensor that uses light to sense the presence of objects. If the light beam is broken, an object is present. Usually the light is reflected back to the sensor via a reflector placed on the opposite side of the conveyor frame from the sensor itself. The 9007 can use either NPN type or PNP type photoeyes. NPN sensors indicate an active state by a grounded connection being made (NPN mode) or a 24 VDC connection being made (PNP mode).
Req	Request from upstream zone to discharge zone in downstream direction.
RollerDrive	One of several types of DC powered rollers manufactured by Interroll Corporation.
Singulated release	A method of releasing packages where packages are allowed into downstream zone only after the trailing edge of the package currently occupying that downstream zone clears the zone's downstream edge sensor.
Singulation	DIP switch 3 chooses either standard or enhanced singulation, significant for all zone types except smart I/O dependent.
Upstream	The opposite of "downstream" (see definition). Typically, the zone to the right of another zone.
Zero motion hold	For DC motors, zero motion hold is a method of holding a motor by applying a small amount of current to the motor winding leads. When the 9007 is commanded to stop and accumulate, the braking action is twofold. First, the motor/package is stopped using dynamic braking. Second, the motor is held in place by zero motion hold. In this state the 9007 will resist being rotated by outside forces.
Zone	A segment of conveyor typically comprised of one RollerDrive and multiple idler rollers interconnected by O-rings or some other device for driving the idlers.
ZPA	Zero pressure accumulation: The process of moving packages on a conveyor in such a manner that they do not touch each other (also *see "ZPA technology", page 7*).

Appendix

Manufacturer's declaration

in terms of the EC-Machine Directive 98/37/EC and its amendment 98/79/EC, Annex II B

The manufacturer:

Interroll Corporation

3000 Corporate Drive

Wilmington, NC 28405

USA

hereby declares with sole responsibility that the product range

- 9007 Hybrid Control for RollerDrive

is not a ready-to-use assembly in terms of the EC-Machine Directive and therefore does not fully comply with the requirements of this directive. It must not be put into service until the machinery into which it is to be incorporated has been declared to conform with the provisions of the Machine Directive.

Applied EC Directives:

Machine Directive 98/37/EC and its amendment 98/79/EC

Low Voltage Directive 2006/95/EC

EMC Directive 2004/108/EC

RoHS Directive 2002/95/EC

Applied harmonized norms:

EN ISO 12100 Part1 and Part2

Wilmington, NC, December 20th 2010

Richard Keely

(Vice President of Manufacturing)

(This declaration can be obtained at www.interroll.com, if needed.)

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